

Sertifikaat

REPUBLIEK VAN SUID AFRIKA

PATENT KANTOOR
DEPARTEMENT VAN HANDEL
EN NYWERHEID



2004/00071

Certificate

REPUBLIC OF SOUTH AFRICA

PATENT OFFICE
DEPARTMENT OF TRADE AND
INDUSTRY

Hiermee word gesertifiseer dat
This is to certify that

2004/00071

REC'D 16 SEP 2004	
WIPO	PCT

the documents annexed hereto are true copies of:

Application forms P.1, P2, provisional specification and drawing of South African Patent Application No. 2003/5446 as originally filed in the Republic of South Africa on 15 July 2003 in the name of DETNET SOLUTIONS (PTY) LTD and an applicant substituted to DETNET SOUTH AFRICA (PTY) LTD on 01 July 2004 for an invention entitled: " DETONATOR ARMING."

Geteken te
Signed at

PRETORIA

in die Republiek van Suid-Afrika, hierdie
in the Republic of South Africa, this

26th dag van
day of July 2004

.....
Registrar of Patents

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH
RULE 17.1(a) OR (b)

REPUBLIC OF SOUTH AFRICA

PATENTS ACT, 1978

REGISTRAR OF PATENTS

Official Application No.		Lodging date: Provisional		Acceptance date:	
21	00	2003/5446	22	15 July 2003	47
International classification		Lodging date: Complete		Granted date:	
51		23			

Full name(s) of applicant(s)/Patentee(s)

71	DETNET SOLUTIONS (PTY) LTD

Applicant(s) substituted:

Date Registered:

71	DETNET SOUTH AFRICA (PTY) LTD	07.04
APPLICANTS SUBSTITUTED		

Assignee(s):

Date Registered:

71		

Full name(s) of inventor(s)

72	KOEKEMOËR, Andre Louis and LABUSCHAGNE, Albertus Abraham

Priority claimed

Country

Number

Date

Note:

33

NONE

31

NONE

32

NONE

Use International

33

31

32

Abbreviation for Country

33

31

32

Title of Invention:

54	DETONATOR ARMING

Address of applicant(s)/patentee(s)

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Patent of Addition to Patent No.:		Date of any change:	
61			
Fresh Application based on:		Date of any change:	

McCALLUM, RADEMEYER & FREIMOND
Ref: P.19956

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978



APPLICATION FOR A PATENT AND ACKNOWLEDGEMENT OF RECEIPT

(Section 30(1) - Regulation 22)

The grant of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate

Revenue Stamps or Revenue Franking
Machine Impression

OFFICIAL APPLICATION NO.

21 01 2003/5446

OFFICIAL DATE STAMP

FULL NAME(S) OF APPLICANT(S)

71 DETNET SOLUTIONS (PTY) LTD

ADDRESS(ES) OF APPLICANT(S)

AECI Place, The Woodlands, Woodlands Drive, Woodmeand, Sandton

TITLE OF INVENTION

54 DETONATOR ARMING

Priority is claimed as set out on the accompanying Form P2.

The earliest priority claimed is: NONE

This application is a patent of addition to Patent Application No.

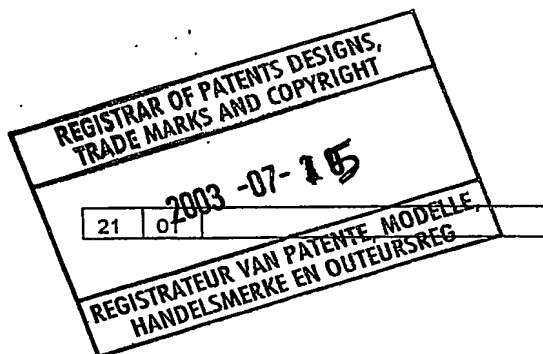
21 01

This application is a fresh application in terms of section 37 and based on Application No.

21 01

THIS APPLICATION IS ACCOMPANIED BY:

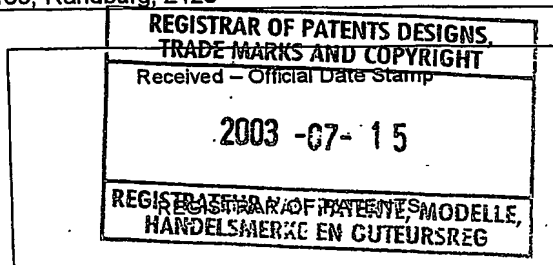
- ☒ 1 A single copy of a provisional specification of ...7... pages
- ☐ 2 Two copies of a complete specification of pages
- ☒ 3 ...1... Sheets of Informal Drawings
- ☐ 4 Sheets of Formal Drawings
- ☐ 5 Publication particulars and abstract (Form P8 in duplicate)
- ☐ 6 A copy of Figure of drawings (if any) for the abstract
- ☐ 7 Assignment of Invention
- ☐ 8 Certified priority document(s) Number(s)
- ☐ 9 Translation of priority document(s)
- ☐ 10 An assignment of priority rights
- ☐ 11 A copy of the Form P2 and the specification of SA Patent Application
- ☐ 12 A declaration and power of attorney on Form P3
- ☐ 13 Request for ante-dating on Form P4
- ☐ 14 Request for classification on Form P9
- ☒ 15 Form P2 in duplicate



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Dated 15 July 2003

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PATENT AGENTS FOR APPLICANT(S)



REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

PROVISIONAL SPECIFICATION

(Section 30(1) – Regulation 27)

OFFICIAL APPLICATION NO

21	.01	2003/5446
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LODGING DATE

22	15 July 2003
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FULL NAME(S) OF APPLICANT(S)

71	DETNET SOLUTIONS (PTY) LTD
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FULL NAME(S) OF INVENTOR(S)

72	KOEKEMOER, Andre Louis and LABUSCHAGNE, Albertus Abraham
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TITLE OF INVENTION

54	DETONATOR ARMING
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BACKGROUND OF THE INVENTION

[0001] This invention is concerned generally with an electronic blasting system and more particularly is concerned with a process whereby a detonator or a series of detonators may be rendered safe regardless of the state of the blasting system or of the integrity of a communications system which is used in the blasting system.

[0002] A blasting system usually incorporates means for testing the wiring in the system and connections between the detonators and a blast controller. During the testing phase and also during a programming phase power must be applied to one or more of the detonators, an operation which raises the risk of an unintended event such as a blast. The risk is increased if one or more detonators are in an armed state and the need to abort the blast arises for the detonators can remain armed if the communication system, used in the blasting system, is faulty. For example a detonator could remain in the armed state and not respond to a disarm signal if there is a poor connection in the communication system, if a detonator is intermittently faulty, if a cable is damaged, due to the ingress of moisture or for any other reason which interferes with communication.

[0003] If a detonator does not disarm, despite the transmission of a disarm signal, then the detonator can remain in the armed state for many hours and, if reconnected to a blasting system, the detonator will remain armed, a condition which could result in an unintended blast.

[0004] It is also practice, when a disarm mode is required, to wait a predetermined time period to allow energy which is stored at each detonator to dissipate to a level which is low enough to ensure that initiation of an explosive cannot take place. The energy at each detonator is normally stored in a capacitor and as the capacitor discharge is exponential it can be necessary to wait a considerable period. If however energy discharge takes place along a path which is defective or damaged then it is impossible to say that the energy level at the detonator is sufficiently low to render it safe. An allied factor is that the electronics which are associated with the detonator might not function satisfactorily, due to the low voltage supply, and settings of the detonator might be lost, creating an undefined and unsafe condition.

SUMMARY OF INVENTION

[0005] The invention provides a method of controlling operation of a detonator which includes the steps of arming the detonator and thereafter, if a defined signal is not received by the detonator within a predetermined period, of placing the detonator in a known safe state.

[0006] The defined signal may be a blast signal or it may be a confirming signal, referred to herein as an "arm-hold" signal.

[0007] The method may require the arm-hold signal to be received at regular intervals in order to maintain the detonator in the armed state.

[0008] For additional security the arm signal, the arm-hold signal and the blast signal may be encrypted or use may be made of an acceptable secure communications protocol – this reduces the likelihood of the detonator reacting to a stray or erroneous signal.

5 **[0009]** The invention also provides a detonator which includes an energy storage device, an energy discharge circuit and a control unit which, after the detonator has been armed, in the absence of a confirming signal from a blast controller, enables the energy discharge circuit thereby to cause energy to be discharged from the storage device.

10 **BRIEF DESCRIPTION OF THE DRAWING**

[0010] The invention is further described by way of example with reference to the accompanying drawing which illustrates, in block diagram form, a blasting system in which the armed state of each detonator is controlled in accordance with the principles of the invention.

15 **DESCRIPTION OF PREFERRED EMBODIMENT**

[0011] The accompanying drawing illustrates, in block diagram form, a blast system 10 which includes a string of electronic delay detonators 12A, 12B ... connected to a blast controller 14 by means of a wiring harness 16.

20 **[0012]** Each detonator is connected to the harness by a respective cable 20 and connector 22.

[0013] The construction of each detonator is not fully described herein for the principles of the invention can, within reason, be applied to most electronic delay detonators which are known in the art. The following description is confined to those aspects of the detonator which are necessary for an understanding of the invention.

[0014] The detonator includes a control unit 30 shown in dotted outline which contains a processor 32 and an energy discharge circuit 34. An energy storage device 36, typically a capacitor, is incorporated in the detonator. The capacitor is used to store energy which is used, inter alia, to initiate blasting, when required. The circuit 34 includes a switch 40 and a load 42.

[0015] As part of a normal blast sequence each detonator 12 must be armed before it can be fired. This process is an integral part of the safe set-up and operating procedure for the blasting system. A detonator is said to be in the armed state when the capacitor 36 has been charged with sufficient energy to fire the detonator and when the processor 32 has been instructed by the blast controller 14, by following a predefined sequence of steps, to enter the armed state.

[0016] In the armed state the detonator only needs a fire command, from the blast controller, to initiate the explosive charge.

[0017] Once a detonator 12 has been placed in the armed state the processor 32 continuously monitors the cable 20 for an arm-hold signal from the blast controller. The arm-hold signal is generated by the blast controller

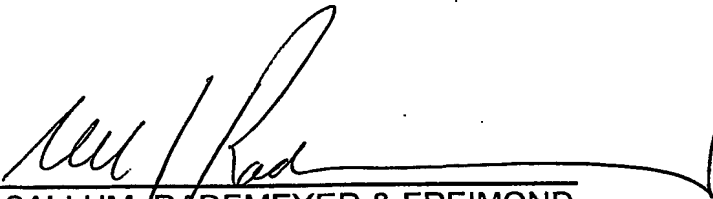
14 according to predetermined criteria and must appear on the cable 20 at regular defined intervals in order for the detonator 12 to be held in the armed condition. If the processor 32 detects the non-appearance of the arm-hold signal then the processor closes the switch 40 in the energy discharge circuit and the energy in the capacitor 36 is dissipated in the load 42. The detonator is thereby automatically placed in a safe condition.

[0018] The aforementioned process means that the detonator is automatically disarmed if any loss of control occurs or if the integrity of any connection to the detonator is defective.

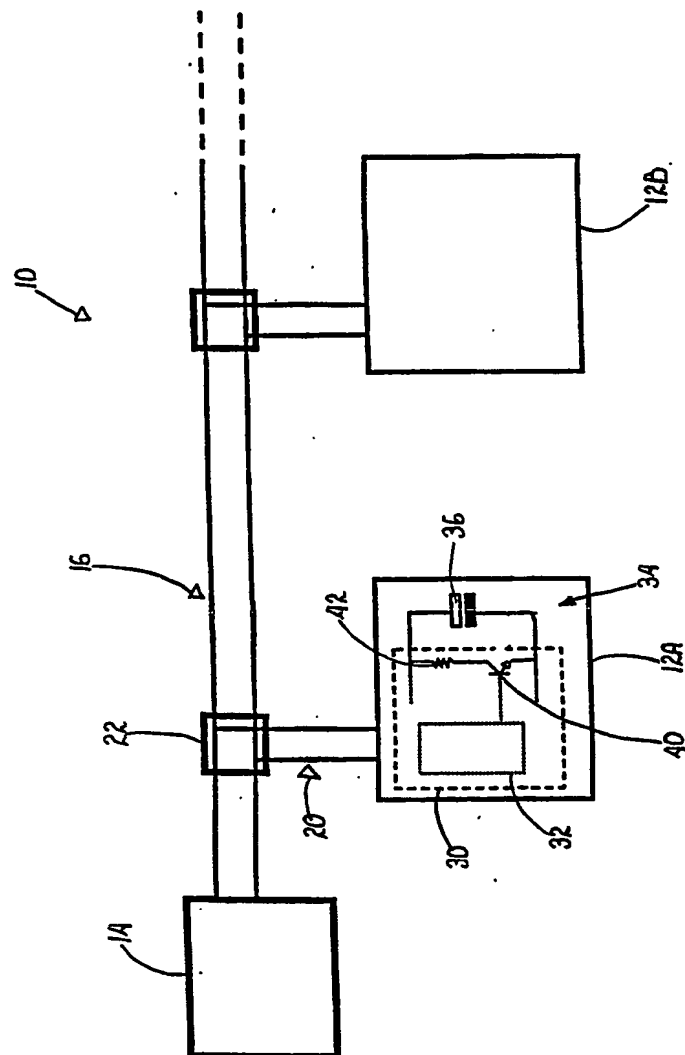
[0019] As indicated the arm-hold signal, which is of a defined format, is required to appear at regular intervals to enable the detonator to be held continuously in the armed state. Alternatively or additionally, if a blast signal is not received from the blast controller within a predetermined period after the detonator is placed in the armed state, a factor which is detected by the processor 32, then a similar process can be carried out automatically in that the processor can cause closure of the switch 40 so that the energy in the capacitor 36 is dissipated.

[0020] The arm, arm-hold and blast signals can be encrypted, or can be sent using a secure communications protocol, to enhance the security of the blast system.

Dated this 15th day of July 2003.


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